Condensation Concerns

Alberta Energy $avers — One of a Series

88-03307/

Publications Available in this Series

Basement Insulation
Caulking and Weatherstripping
Heating System Maintenance
Selecting a Heating System
Attic Insulation
Condensation Concerns
Re-siding for Energy Conservation
Windows
Ventilating Your Home
Water and Electricity

For information on other energy conservation topics, call our toll-free line:

Energy MATTERS

Dial 0 and ask for ZENITH 22339
(Edmonton 427-5300)

or write:
Alberta Department of Energy
Energy Conservation Branch
2nd Floor, Highfield Place
10010 - 106 Street
Edmonton, Alberta
T5J 3L8

Condensation Concerns

Edmonton
1986

Alberta
ENERGY
Energy Conservation Branch

ENR I/17 - No. 9
ISBN 0-86499-167-3
First Printed 1984

Distribution of this publication by commercial firms does not imply provincial government approval or endorsement for products or services offered for sale.

Individual copies of this publication available at no charge within the province.

Contents

Introduction 1

Understanding Condensation 1

- What is Condensation? 1
- Surface Condensation 2
- Concealed Condensation 4

Causes of Condensation...and Solutions 6

- Identifying the Problem 6
- Moisture Sources and Causes 13
  - Normal Home Operation 13
  - Changes to Normal Home Operation 15
- Controlling Moisture in the Home 16
  - Increasing the Fresh Air Supply 18
  - Adding Mechanical Ventilation 19
  - Incorporating an Air-to-Air Heat Exchanger 21

Introduction

Many Albertans are concerned that condensation may be causing serious damage in their homes. In most cases, in our dry climate, condensation is not a big problem.

Sudden changes in the weather can result in the minor short-term condensation problems that could be a concern to some homeowners. In recent years, however, efforts to conserve energy, such as changing the heating system, improving air-tightness or constructing a new energy-efficient home, have resulted in signficant and long-lasting condensation problems.

This publication should help put any concerns you have in perspective. It must be noted that the severity of condensation problems and their effect on your home depend on many factors. A few windows fogged on very cold days or an isolated spot of mould are not likely to be serious. On the other hand, large ceiling stains or water running down windows and walls are probably serious problems and need immediate action.

Condensation Concerns deals with typical condensation problems, their causes and their solutions.

Understanding Condensation

What Is Condensation?

Condensation is the change of water vapour in the air to liquid water on a cold surface. It occurs because air can hold only a limited amount of water vapour at any one temperature. The lower the temperature, the less the amount of water vapour the air can hold.

If the temperature of moist air is lowered by a cool surface (beyond its maximum water vapour holding capacity) liquid water will form on the cold surface — this liquid water is called condensation. The interior surfaces in a home can be at very different temperatures, depending on insulation, air leakage, the exterior air temperature and exposure to sun and wind. When considering condensation, the coldest surfaces are places of greatest concern.

In most houses the coolest interior surface temperatures will be on the window glass (Figure 1). The interior air coming in contact with this surface is cooled dramatically to the point where condensation occurs. The amount of condensation increases as the surface temperatures become colder or as more water vapour is added to the air in the home.

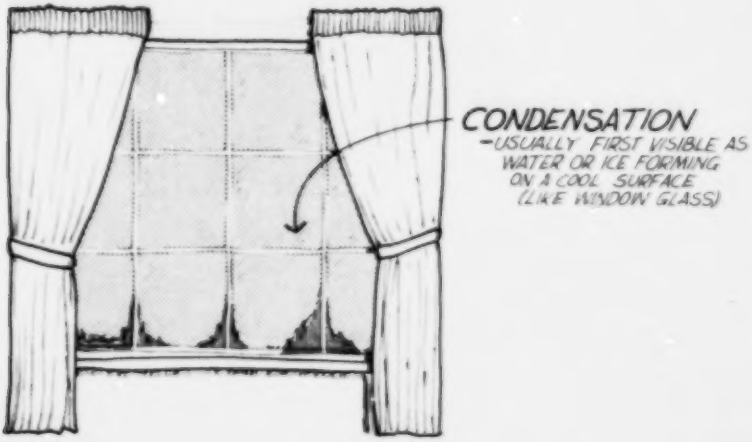

Figure 1

Surface Condensation

Surface condensation is a visible indication of a high moisture content in the air. It is a common problem in Alberta homes and usually only requires minor actions to prevent its occurrence. It is often seen as condensation on windows, inner wall surfaces and cold water pipes or around electrical outlets. Surface condensation is not necessarily serious but it can become a problem if it persists for many days on many surfaces or to the point where it results in staining, mould growth or finish deterioration.

The following table lists some outdoor temperatures along with the indoor humidity levels at which condensation begins to appear on inner glass surfaces of windows — usually the coolest surface in a room. You will see from the table that at very cold exterior temperatures it may be difficult to maintain a comfortable interior relative humidity level of 30 per cent without some water appearing on window surfaces.

Table 1

Window Condensation*

If the interior relative humidity level is:	Then condensation will occur on the inner window surface if the outside temperature is less than:		
	Single Glazed Windows °C (°F)	Double Glazed Windows °C (°F)	Triple Glazed Windows °C (°F)
20%	-9 (16)	-30 (-22)	
25%	-5 (23)	-24 (-11)	
30%	0 (32)	-15 (5)	
35%	1 (34)	-10 (14)	Below -40 (-40)
40%	3 (37)	-7 (19)	-40 (-40)
45%	5 (41)	-4 (25)	-28 (-18)
50%	8 (46)	0 (32)	-18 (0)

* Room air temperature at 23°C (73°F)

Note: Covering the window with a curtain can restrict air movement. This results in a cooler glass surface which increases condensation.

From Table 1 you can see that triple glazed windows (with three layers of glass — Figure 2) will allow higher interior relative humidity levels to be maintained without window condensation than double or single glazed units. The extra glass layers and trapped air between help keep the inner surface warmer.

Interior surface condensation can occur on any cool surface — cold water pipes, poorly insulated walls or floors, metal hinges or locks on exterior doors — not just on window surfaces. A high relative humidity with cold surface temperatures will create the most severe problems. This type of condensation can occur no matter how well built a home is.

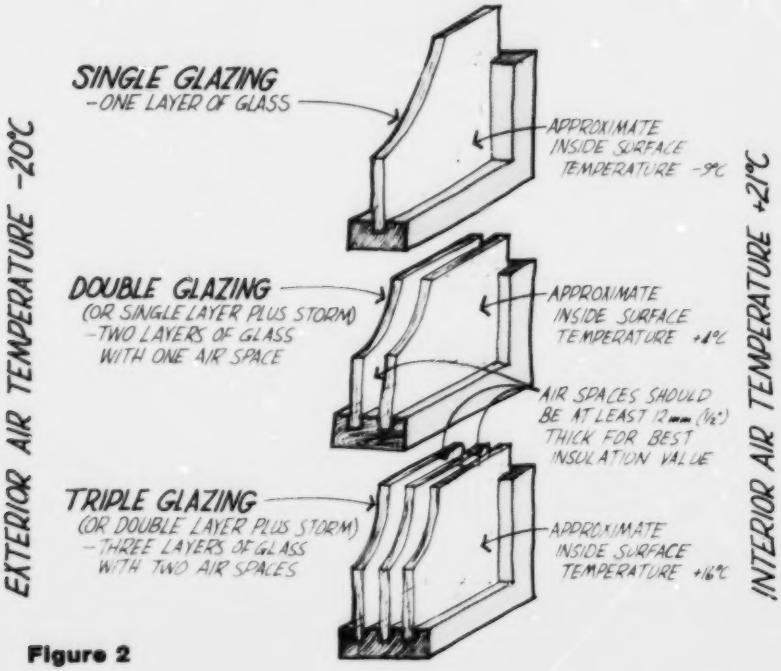

Figure 2

Concealed Condensation

Concealed condensation can occur when warm moist air goes out through cracks, gaps or holes in the building shell (walls, floors or ceilings). It may also occur when water vapour diffuses through building materials. Diffusion, the molecular movement of water vapour through solid materials, is caused by differences in pressure. Diffusion of water vapour accounts for a very small portion of moisture movement through the walls of homes. By far the greatest problems with concealed condensation occur from the movement of warm moist air through the building shell.

If warm moist air is allowed to leak out through a gap in an exterior assembly during cold weather, at some point in the passage through the structure the relative humidity level will reach 100 per cent (the air is cooled and cannot hold as much water vapour). Condensation will occur on the closest available surface — often the inside face of the exterior sheathing on outside walls, for example (Figure 3). If the outside temperature is quite low, water vapour may deposit directly as ice or frost.

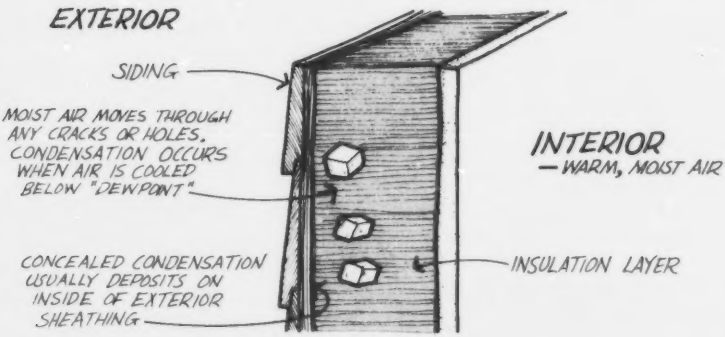

Figure 3

If the amount of water or ice is small, it may change directly back into water vapour and be carried away by natural air movement with little damage to the structure. But large deposits of ice will melt and can soak insulation materials, destroy interior or exterior finishes, or lead to structural deterioration.

Fortunately, concealed condensation is not generally a major problem in our climate. Air leakage in the normal home involves warm air moving out through vents, ducts and chimneys. The cold air drawn in to replace it carries little total moisture — the initial relative humidity may be quite high, but as the air warms to room temperature the final relative humidity may be reduced to less than 10 per cent. The resulting dry indoor environment, often requiring humidification, is usually a sign that a great deal of outside air is leaking in. This causes drafts, reduces comfort and increases heating costs.

However, even in our climate concealed condensation can result when a vapour barrier is created on the outside of a wall — for example, when some types of board insulation are improperly applied before re-siding a home. The joints between the boards should not be sealed during installation. If they are sealed, moisture that normally moves through the wall will be trapped. The resulting condensation could cause deterioration of the insulation or the building structure.

Causes of Condensation ...and Solutions

Identifying the Problem

Every homeowner should know how to recognize condensation problems, how to evaluate their seriousness and how to solve them. A sudden increase in humidity may indicate a basement leak, a broken water pipe or a faulty chimney — all harmful problems which should be remedied immediately. A summary of the common areas where condensation and moisture buildup occur along with possible causes and suggested solutions is presented in the following table. Table 2 indicates most condensation problems result from high humidity levels and some other cause such as air leakage, a cold surface or a sudden temperature drop.

Table 2

Condensation Problems, Causes and Solutions

Area	Indication	Possible Causes
Windows	• Condensation on most inside surfaces of inner pane	• Abnormally high humidity • Setting thermostat to lower temperature at night • Sudden change to colder weather • Poor air circulation in home
	• Condensation on upper storey windows only	• Cool air leaking in lower level, warm air leaking out upper level
	• Condensation on windows on one side of house only	• Cold air forced in windward side, warm air drawn out on downwind side
	• Condensation on north side windows only	• Inner surfaces cooler than on south-facing windows during daylight
	• Condensation on windows in one or two rooms	• Room(s) cooler than rest of house
	• Condensation between layers of glazing	• Air leakage from inside into space between glazing • Outer storm window sealed • Broken seal

Suggested Solutions

- Control humidity sources (see Table 5)
- Add layer of glass or plastic on inside (see Table 1) to increase interior surface temperature (Figure 2)
- Condensation should disappear as house warms up (adjust thermostat setback slightly higher if condensation is severe)
- Ventilate home to lower humidity level; control sources of moisture (humidifier, showers, etc.)
- Open drapes; move furniture or objects blocking warm and cold air registers; run furnace fan continuously, to improve air circulation

- Improve caulking and weatherstripping to lower cold air infiltration (see **Caulking and Weatherstripping** booklet), making sure there are still adequate fresh and combustion air supplies (Figure 5)

- Improve caulking and weatherstripping to lower cold air infiltration (see **Caulking and Weatherstripping** booklet)

- Open drapes and improve air circulation; add layer of glazing on inside

- Open drapes; leave room door(s) open; run furnace fan continuously, to improve air circulation

- Seal inner pane between glass layers with caulking or replace weatherstripping between sliding units (see **Caulking and Weatherstripping** booklet)
- Seal inner unit; allow outer unit to breathe to exterior
- Replace window with good quality new sealed unit

Area	Indication	Possible Causes
	• Condensation on window frame	• Air leakage through rough opening space, poor weatherstripping • Air leakage between frame, sash and meeting rails • Poor quality metal or plastic frames
Doors	• Condensation on door	• Uninsulated door
	• Condensation around door frame and threshold	• Air leakage around door
	• Condensation on locks, hinges and doorknob	• Metal surface exposed directly to exterior
Walls	• Condensation on walls in closets	• Poor air circulation around clothes
	• Condensation and staining below window	• Melted window condensation • Window in very humid area • Insulation missing from wall
	• General condensation on many walls in the home	• Abnormally high humidity level • Poor air circulation • Missing insulation
	• Condensation in corners	• Incoming cold air • Poor air circulation
	• Mould on wall surface	• Abnormally high humidity levels • Poor ventilation of humid spaces • Poor air circulation

Suggested Solutions
• Seal between frame and rough opening space; improve caulking and weatherstripping (see **Caulking and Weatherstripping** booklet) • Install sealed interior plastic or Plexiglas storm or shutter
• Replace with good quality wood, hollow core units or units with a thermal break
• Replace with well-insulated door or add storm door
• Replace or readjust weatherstripping and threshold or add storm door (see **Caulking and Weatherstripping** booklet)
• Add storm door
• Open doors; add louvres or grilles; undercut doors; leave space next to outside wall, to improve air circulation
• Improve window as outlined above • Eliminate window unit and insulate opening • Add insulation to wall cavity
• Control humidity sources (see Table 5) • Operate furnace fan continuously • Add insulation to wall cavities where missing
• Caulk any cracks to exterior (see **Caulking and Weatherstripping** booklet) • Move furniture or objects blocking warm and cold air registers; run furnace fan continuously, to aid air circulation
• Control humidity sources (see Table 5) • Use fans; add mechanical ventilation (Figure 6) • Move furniture or objects blocking warm and cold air registers; run furnace fan continuously, to aid air circulation

Area	Indication	Possible Causes
	• Frost on basement walls	• Abnormally high humidity levels • Air leakage at sill plate, uninsulated walls
	• Condensation around electrical outlets	• Incoming cold air
	• Water on basement floor or walls	• External sources like runoff, rain or ground water • Abnormally high moisture level
	• Stains on ceiling	• Frost buildup melting in attic when weather warms • Leaking roof
Ceiling/ Attic	• Frost on exposed nails in attic	• Small amount of warm air leaking into attic space
	• Large isolated frost deposit in attic	• Indicates large volume of warm and moist air leaking into attic space • Inadequate attic space ventilation
Other	• Condensation on cold surfaces such as pipes, toilet tank, etc.	• Abnormally high humidity level • Very cold water supply
	• Exterior paint peeling	• Lack of air/vapour barrier • Rain penetration behind siding
	• Structural damage to studs, joists or rafters	• Bacterial action due to warm, moist and dark environment

Suggested Solutions
• Control humidity sources (see Table 5) • Seal and insulate basement walls (see **Basement Insulation** and **Caulking and Weatherstripping** booklets)
• Seal under plates (see **Caulking and Weatherstripping** booklet)
• Seal wall; install weeping tile; direct gutter drains away from wall; maintain ground slope away from wall; check that existing weeping tiles are open • Control sources of moisture (see Table 5)
• Add vents to overcome inadequate attic ventilation; seal air leaks into attic space from below (see **Attic Insulation** booklet) • Repair roof leak
• Occurs normally during cold weather in most homes (check for adequate ventilation — see **Attic Insulation** booklet)
• Identify source; caulk or seal leak at ceiling level (large amounts usually occur around stacks or from poorly sealed exhaust ducts — make sure all exhausts vent to exterior, not into attic space) • Add attic vents (see **Attic Insulation** booklet)
• Control humidity sources (see Table 5) • Insulate pipes or toilet tank
• Add air/vapour barrier to interior or paint with vapour barrier paint on interior surfaces; seal around electrical outlets • Identify and caulk any leaks or gaps on exterior; repair flashings
• Identify cause of leakage (external or concealed condensation); replace damaged members; seal wall, floor or ceiling assembly to prevent recurrence

Moisture Sources and Causes

Normal Home Operation

In an average home there are many sources and causes of humidity — some evaporating periodically, some constantly, others adding moisture directly to the air. Table 3 lists most of the typical sources of moisture which affect the relative humidity level in the home.

Table 3

Moisture Sources in the Home

Type	Typical Source	Litres (Gallons) Per Week Added to Air in Home
Continuous	Occupants (typically four)	30-40 (7-9)
	Showers (eight/week)	18-29 (3-5)
	Drying clothes indoors	12 (2.6)
	Cooking (steam from pots)	9 (2)
	Gas cookstove	9 (2)
	Frost-free refrigerator	9 (2)
	Dishwashing (in sink)	3 (0.7)
	Large house plant (over 1 metre tall)	3 (0.7)
	Bathing (eight/week)	3 (0.7)
	Washing clothes	2 (0.4)
Seasonal	Summer moisture gained by furniture and materials (trapped when windows closed in fall — may last 3 or 4 weeks)	40 (9)
	Damp basement or crawlspace under portion of home	14 (3)
	Unvented kerosene heaters (depends on use)	5 (1.1)

Most homes in Alberta quickly eliminate the extra moisture released into their atmosphere and condensation is not a problem. In fact, many homes have such a low relative humidity in winter that humidifiers are used to add more water vapour to the air. As illustrated in Figure 4 (top), air leakage and the effect of the chimney continually exhausting warm air results in much outside air being drawn into the home. Regardless of its initial relative humidity, when that cold

air is heated to room temperature it is quite dry and readily absorbs the normal moisture production of the home.

However, you may find you have altered the situation in your home to the point where water vapour production and loss are no longer equal. Increased caulking and weatherstipping to reduce air leakage, the installation of a chimneyless furnace, a serious water leak or a blocked chimney are but a few of the ways in which the moisture balance may change in the home. The situation of cold air being continually drawn in (a negative pressure) can even change into one where warm air is being forced out (a positive pressure) — shown in Figure 4 (bottom).

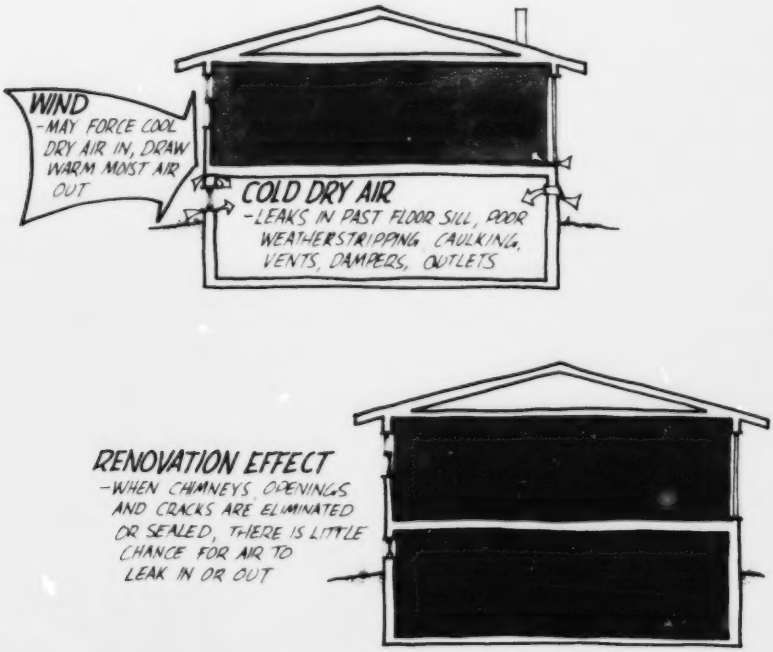

Figure 4

Changes to Normal Home Operation

Excessive humidity and concealed condensation can become problems when previous routes for moisture escape have been closed or when more moisture is being produced than can escape. The average home needs about 35 litres per second (70 cubic feet per minute) of ventilation to control humidity and maintain air quality. Higher insulation levels and lower air leakage rates, the result of extensive retrofitting or the building of a new energy-efficient house, can cause higher interior humidity levels. The humidity can be controlled using a ventilation system (as shown later in Figures 5, 6 and 7).

Table 4 summarizes some of the unusual causes or sources of high humidity in a home.

Table 4

Unusual Causes and Sources of High Humidity in the Home

Cause or Source of Moisture	Comments
Faulty or plugged chimney serving any fuel-fired appliance (furnace, hot water heater, etc.)	Water vapour forms a large portion of the products of combustion so unusually high moisture levels can be an indication of a plugged or leaking chimney vent and MUST BE CORRECTED IMMEDIATELY (have heating contractor or utility company test system)
New home or large addition	As much as 36 litres (8 gallons) of moisture a week are released from new building and finishing materials during the first 18 months of occupancy
New, energy-efficient home	In addition to moisture from building materials, low air leakage rate means controlled ventilation (Figures 5 and 6) must be used to prevent the buildup of moisture from day-to-day activities
Extensive retrofitting (renovating for energy efficiency — done to lower fuel consumption and cost)	Stopping the sources of air leakage (fresh, dry air) means that moisture that formerly leaked out (Figure 4) must now be ventilated to prevent high humidity in the home

Installation of a high-efficiency (chimneyless) furnace	Blocking off the chimney will eliminate one major source of air leakage but can create problems with moisture buildup in the home which must be solved with additional ventilation
Flooded basement	A major water source such as a broken water pipe, spring run-off or a high water table can bring up to 900 litres (200 gallons) of moisture into the home each week if it is not controlled — proper ground slope, weeping tile and gutters directed away from basement walls can help prevent flooding situations
Minor leaks and water sources	Items such as leaking roofs, water pipe breaks, badly dripping taps, steam cleaning of carpets, mopping floors or the storage of a large quantity of green wood can introduce a lot of moisture into the home — recognize and control the source
Other	Operating a hot tub or pool in the home, trying to maintain a tropical atmosphere for plants or throwing a large party can be activities that overload the home with moisture

Controlling Moisture in the Home

Table 5 outlines a number of steps that can be taken to lower home humidity levels. The initial steps are simple and may provide easy solutions to most home moisture problems. Working further through the chart leads to more complex and detailed solutions — but in cases of very high humidity and low air leakage, those solutions may be required for condensation control in the home. **Always try the simple steps first to solve condensation problems. If they don't work, use the more complex solutions given.**

The main concern is to use the preceding information to help you identify the sources of moisture so the specific ones can be controlled. Some of the information in Table 5 will require a fair amount of work and expertise to carry out. Information following the table will provide some details on the techniques suggested.

Table 5

Controlling Humidity in the Home

Action Required	Comments
Personal actions	• Cover cooking pots (eliminates steam, conserves energy) • Hang fewer wet towels or clothes indoors to dry (or use clothes dryer) • Take shorter showers
Turn humidifiers down (or off)	• May require shutting off water supply to furnace humidifier • Use individual room humidifiers sparingly
Check that clothes dryer is vented to exterior	• Electric and gas dryers MUST BE VENTED TO EXTERIOR (electric dryer may have been vented indoors as a heat-saving measure)
Operate venting fans	• Use individually to control humidity from showers, cooking, etc. (run a few minutes after the activity to ensure moisture is removed) • Use only when required since heated air is being exhausted
Operate furnace fan continuously	• Set switch for summer operation (fan runs constantly) • Use two-speed fan (runs continually at low speed, switches to high speed for heating cycle) • Improved circulation will help reduce localized condensation
Isolate moisture-producing areas	• Close windows and doors to greenhouses, indoor pools and hot tub spaces • Do not draw air into the heating system from humid areas • Add separate exhaust venting system

Action Required	Comments
Cover exposed earth in basements or crawlspace	• Must have a ground cover like heavy polyethylene or roll roofing overlapped by 100 mm (4") and weighed down or protected by sand layer (ventilate space in summer according to Alberta Building Code)
Increase outside air supply to heating system	• Fresh air duct with variable damper allows a controlled amount of dry outside air into the home (Figure 5)
Add mechanical venting	• Install fans in moisture-producing areas like bathrooms, laundry areas or the kitchen (but use only when required since heated air is exhausted) • Can be controlled with a single fan and humidistat (which only operates when the humidity goes above a pre-set level — Figure 6)
Install air-to-air heat exchanger into venting system	• Can recapture up to 80% of the heat from the outgoing air (Figure 7) • Expensive item (costs and benefits must be weighed)

Note: The installation of a dehumidifier is not a solution to overall home humidity problems because it is only capable of lowering the relative humidity to 50 or 60 per cent.

Increasing the Fresh Air Supply

One method that may be required to control humidity buildup in the home is to install a controlled source of fresh air. An insulated duct is installed from the exterior to the return air plenum of the forced-air heating system (Figure 5). Although required by the building code in new homes, this fresh air supply source is often lacking in most older homes. Installing this duct (with an adjustable 50 per cent damper) can introduce a new source of dry outside air in homes renovated to cut down air leakage heat loss.

The damper is designed so that no more than 50 per cent of the duct is blocked off when it is in the "closed" position (so the air supply cannot be totally stopped). For correct operation, the damper is adjusted so that a small amount of condensation shows on the inside of window glass. It is then opened or

Table 5

Controlling Humidity in the Home

Action Required	Comments
Personal actions	• Cover cooking pots (eliminates steam, conserves energy) • Hang fewer wet towels or clothes indoors to dry (or use clothes dryer) • Take shorter showers
Turn humidifiers down (or off)	• May require shutting off water supply to furnace humidifier • Use individual room humidifiers sparingly
Check that clothes dryer is vented to exterior	• Electric and gas dryers MUST BE VENTED TO EXTERIOR (electric dryer may have been vented indoors as a heat-saving measure)
Operate venting fans	• Use individually to control humidity from showers, cooking, etc. (run a few minutes after the activity to ensure moisture is removed) • Use only when required since heated air is being exhausted
Operate furnace fan continuously	• Set switch for summer operation (fan runs constantly) • Use two-speed fan (runs continually at low speed, switches to high speed for heating cycle) • Improved circulation will help reduce localized condensation
Isolate moisture-producing areas	• Close windows and doors to greenhouses, indoor pools and hot tub spaces • Do not draw air into the heating system from humid areas • Add separate exhaust venting system

Action Required	Comments
Cover exposed earth in basements or crawlspace	• Must have a ground cover like heavy polyethylene or roll roofing overlapped by 100 mm (4") and weighed down or protected by sand layer (ventilate space in summer according to Alberta Building Code)
Increase outside air supply to heating system	• Fresh air duct with variable damper allows a controlled amount of dry outside air into the home (Figure 5)
Add mechanical venting	• Install fans in moisture-producing areas like bathrooms, laundry areas or the kitchen (but use only when required since heated air is exhausted) • Can be controlled with a single fan and humidistat (which only operates when the humidity goes above a pre-set level — Figure 6)
Install air-to-air heat exchanger into venting system	• Can recapture up to 80% of the heat from the outgoing air (Figure 7) • Expensive item (costs and benefits must be weighed)

Note: The installation of a dehumidifier is not a solution to overall home humidity problems because it is only capable of lowering the relative humidity to 50 or 60 per cent.

Increasing the Fresh Air Supply

One method that may be required to control humidity buildup in the home is to install a controlled source of fresh air. An insulated duct is installed from the exterior to the return air plenum of the forced-air heating system (Figure 5). Although required by the building code in new homes, this fresh air supply source is often lacking in most older homes. Installing this duct (with an adjustable 50 per cent damper) can introduce a new source of dry outside air in homes renovated to cut down air leakage heat loss.

The damper is designed so that no more than 50 per cent of the duct is blocked off when it is in the "closed" position (so the air supply cannot be totally stopped). For correct operation, the damper is adjusted so that a small amount of condensation shows on the inside of window glass. It is then opened or

closed as necessary to maintain the slight condensation as the outside temperature varies.

This duct provides fresh air to the home for humidity control as well as a combustion air supply for fuel-burning appliances like the furnace, hot water heater or boiler (as shown in Figure 5). The duct outlet from the hot air plenum, which supplies the combustion air, does not have a damper and so cannot be blocked.

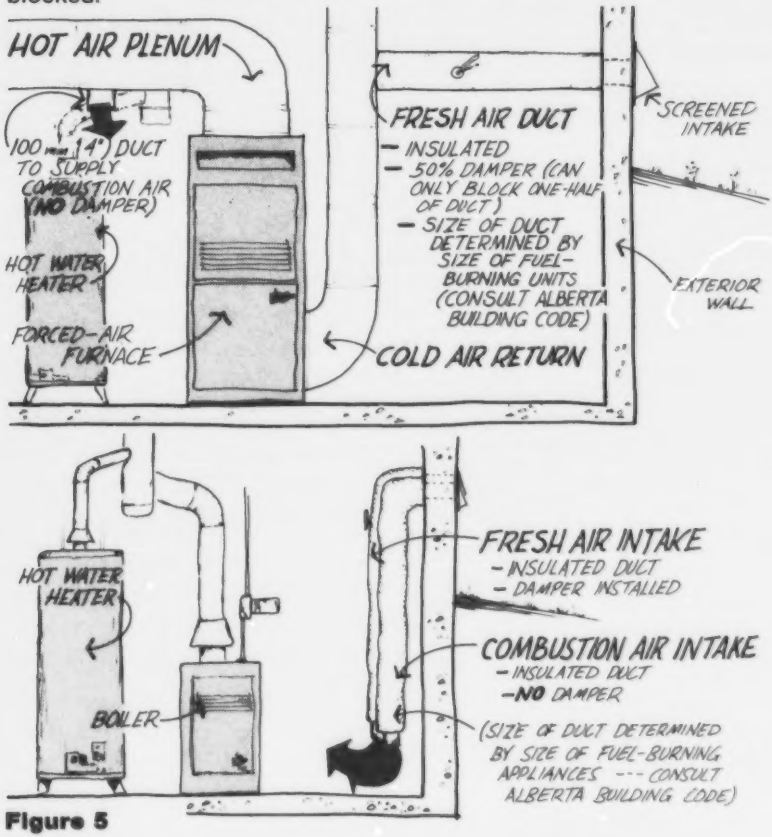

Figure 5

Adding Mechanical Ventilation

Older homes often do not have exhaust fans installed in moisture-producing areas like bathrooms, laundry room or kitchen. If the installation of a fan is required to control

humidity in a space, it is best to install it as shown in Figure 6 — on an interior wall, venting down the wall cavity and exiting through the joist space. This location eliminates potential problems in the attic. Make sure exhaust fans mounted as indicated are powerful enough to move the air the distances required.

If vents must be installed through the attic and roof or soffit, be sure they have automatically closing dampers. The installation must be sealed and insulated so that warm, moist air cannot leak into the attic space (see **Attic Insulation** booklet).

If two or three exhaust locations are required, they can be joined and operated with a single, large variable-speed fan (Figure 6). Controlling that single exhaust fan with a humidistat will enable the homeowner to set the desired humidity level and allow the fan to operate as needed to control the level — running at a high speed when someone is showering or many people are in the home, operating at a slower speed during normal activities or shut off at night when little moisture is being produced. The desired humidity level may vary (high during most periods, lower during cold weather to minimize window condensation).

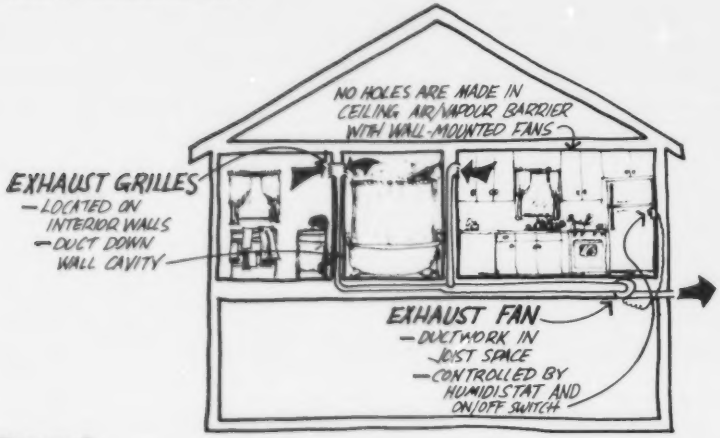

Figure 6

It is important that the exhaust system be operated at a minimal rate as it is heated air that is being blown out of the house. The air exhausted may have to be replaced if the

home is so air-tight that air leakage is not forced through any cracks or holes. Replacement air can be brought in through a fresh air vent as shown in Figure 5.

The ease with which this type of system can be installed will depend on the accessibility to walls and the basement ceiling. The benefits in terms of efficiency and controlled ventilation, however, far outweigh those of standard ceiling fan units.

Incorporating an Air-to-Air Heat Exchanger

As mentioned, operating exhaust systems can control the buildup of excessive humidity. But one has to remember the exhaust is also removing heated air — air that you have already paid to heat! If little air needs to be exhausted to control humidity, nothing can be done to recapture the heat. However, if large volumes of air are continually being exhausted, then an air-to-air heat exchanger can be installed to recapture a portion of the heat from the outgoing air.

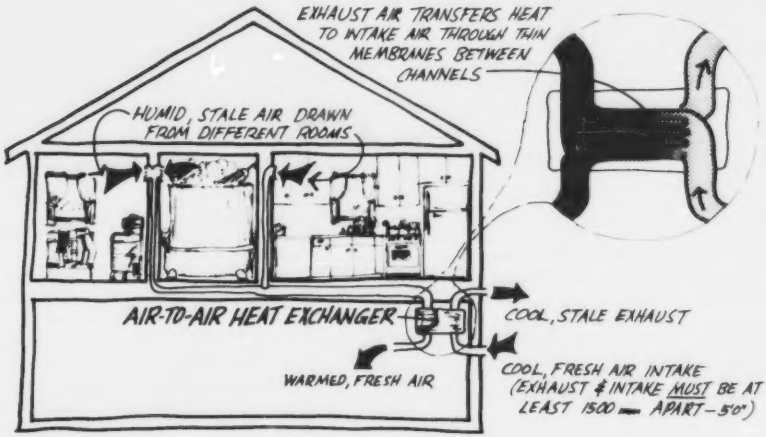

Figure 7

Heat exchangers are devices in which warm air is exhausted past cold incoming air. The two air streams are separated by a thin membrane which allows heat, but not odours, to be transferred (Figure 7). Although expensive, these devices can recapture up to 80 per cent of the heat from the exhaust air. They must be installed into a ventilation system from a centralized exhaust point (as shown in Figure 6). Heat exchangers are generally only considered economically justifiable in very air-tight, energy-efficient houses.

Summary

If you are noticing signs that the humidity level in your home is too high, try the following steps:

- Note the type of problem
  - a light fog on windows
  - water or ice on walls
  - stains on the ceiling
- Establish whether the problem is isolated or widespread
  - just a few windows fogged or a small stain on the ceiling
  - many windows or walls with condensation
  - only one or two areas of the home affected
- Determine what is causing the problem (use Table 2)
  - is the humidity level too high?
  - has there been a change to colder weather?
  - is there a water leak or other new source of moisture?
  - is your home new or has a large addition been constructed?
  - have there been any equipment changes?
  - has the chimney been checked recently for leaks or blockages?
  - have you taken measures to stop air leakage?
- Take action to rectify the situation
  - control the sources of humidity first
  - if condensation is isolated, remedy the problem area (air leak, water leak, missing insulation, etc.)
  - if condensation is widespread, add ventilation to lower the humidity level

By using the tables, diagrams and other information in this publication you should be able to understand relative humidity in the home and control condensation problems.